

Remarks/Arguments:

Claims 3 and 4 have been amended. Claims 7 and 8 have been added. No new matter is introduced herein. Claims 1-8 are pending.

Claim 3 has been objected to. In particular, the phrase "placed at positions symmetrical positions each other" is objected to as being unclear. Claim 3 has been amended to clarify that the second and third radiators are placed at positions symmetrical to each other. Accordingly, Applicants respectfully request that the objection to claim 3 be withdrawn.

Claims 1-6 have been rejected under 35 U.S.C. § 103(a) as being unpatentable over Rutfors et al. (U.S. 2003/0189519) in view of Colburn (U.S. 2005/0162321). It is respectfully submitted, however, that these claims are patentable over the cited art for the reasons set forth below.

With respect to claims 1 and 2, Applicant respectfully traverses this ground for rejection for the reasons set forth below.

Claim 1 includes features neither disclosed nor suggested by the cited art, namely:

... an unbalanced antenna including ... a first radiator ... the first end ... being connected with the first feeding point ... a load conductor ...

... a balanced antenna including ... a second radiator ... a third radiator ...

... the load conductor has a shape symmetrical about a straight line which passes through the first feeding point and which is perpendicular to the ground board ...

... the second radiator and the third radiator are placed at positions symmetrical to each other about the straight line, respectively, and have shapes symmetrical to each other about the straight line ...

Claim 2 includes a similar recitation, namely:

... the load conductor has a shape electrically symmetrical about a straight line, the straight line passing through the first feeding point and being perpendicular to the ground board ...

... the second radiator and the third radiator are placed at positions electrically symmetrical to each other about the straight line, respectively, and have shapes electrically symmetrical to each other about the straight line ...

Rutfors et al. disclose, in Fig. 2, an unbalanced Planar Inverted F Antenna (PIFA) 20 and a balanced dipole antenna 230 that surrounds PIFA antenna 20 (paragraphs [0023], [0034] and [0037]). The PIFA antenna includes radiating element 20 that is spaced apart from and parallel to PCB 10 and includes a feeding portion 22 connected to a feed element of transmitter portion 24 and a grounding portion 23 connected to a ground element of the transmitter portion (paragraph [0023]).

Rutfors et al. do not disclose or suggest that 1) a load conductor has a shape symmetrical (electrically symmetrical) about a straight line which passes through the first feeding point and which is perpendicular to the ground board or that 2) the second radiator and the third radiator are placed at positions symmetrical (electrically symmetrical) to each other about the straight line (emphasis added), as required by respective claims 1 and 2. These features are neither disclosed nor suggested by Rutfors et al. In addition, on page 3 of the Office Action, the Examiner acknowledges that Rutfors et al. "fails to teach the load conductor has a shape symmetrical about the straight line." In Fig. 2 of Rutfors et al., if a straight line perpendicular to PCB 10 were to pass through the feeding device 24, the straight line would not pass through feeding portion 22 and the radiating element 20 would not be symmetrical about the straight line passing through the feeding device 24. In addition, dipole antenna 230 would not be symmetrical to the straight line perpendicular to PCB 10 that passes through the feeding device 24. Thus, Rutfors et al. do not include all of the features of claims 1 and 2.

Colburn et al. disclose, in Fig. 1, an antenna 10 including E-shaped metal plate 12 located at a distance from ground plane 14. Shorting tab 22 and feed tab 20 are centered on metal plate 12 and are connected between plate 12 and ground plane 14 (paragraphs [0025] and [0027]). Colburn et al. further describe that antenna 10 is a combination of an inductively loaded center fed patch antenna and a PIFA ([0026]).

Colburn et al. do not disclose or suggest that 1) a load conductor has a shape symmetrical (electrically symmetrical) about a straight line which passes through the first feeding point and which is perpendicular to the ground board or that 2) a second radiator and a third radiator are placed at positions symmetrical (electrically symmetrical) to each other about the straight line (emphasis added), as required by claims 1 and 2. These features are neither disclosed nor suggested by Colburn et al. Colburn et al. do not teach an unbalanced antenna and a balanced antenna and thus cannot disclose or suggest a balanced antenna where the second and third radiator are placed at positions symmetrical (electrically symmetrical) to each other about a straight line passing through the feeding point of the outbalanced antenna.

In addition, Colburn et al. teach that the shorting tab 22 and feed tab 20 are centered on metal plate 12 so that feed tab 20 is connected to transceiver 28 as shown in Fig. 2. In contrast, Rutfors et al. show that feeding portion 22 is connected to an edge of PIFA antenna 20 and is surrounded by dipole antenna 230. Although Rutfors et al. discloses, in paragraph [0043] that the unbalanced antenna can be a patch, a modified PIFA, a meander PIFA or a slot, Rutfors et al. do not disclose or suggest modifying the connection of the unbalanced antenna 20 to grounding portion 23, feeding portion 22 and feeding device 24 with respect to PCB 10. Accordingly, combining Rutfors et al. with Colburn would change the principal of operation of at least one of the antennas of Rutfors et al. and Colburn et al. Thus, the skilled person would not be motivated to combine Rutfors et al. with Colburn et al. Thus, Colburn et al. do not include all of the features of claims 1 and 2 and would not be combined with Rutfors et al. to produce the subject invention. Accordingly, allowance of claims 1 and 2 is respectfully requested.

With respect to claims 3 and 4, it is respectfully submitted that these claims are patentable over the cited art for the reasons set forth below.

Claim 3, as amended, includes features neither disclosed nor suggested by the cited art, namely:

... each of the load conductor and the first radiator has a shape symmetrical about a plane, the plane extending perpendicular to the ground board and passing through the first feeding point ...

... the second radiator and the third radiator are placed at positions symmetrical to each other about the plane, respectively, and have shapes symmetrical to each other about the plane ... (Emphasis Added)

Claim 4 includes a similar recitation. Namely, that 1) each of the load conductor and the first radiator has a shape electrically symmetrical about a plane where the plane extends perpendicular to the ground board and passes through the first feeding point and 2) the second and the third radiators are placed at positions electrically symmetrical to each other about the plane. Basis for the amendment can be found, for example, at page 9, lines 12-17; and Figs. 9 and 10 of the original specification. For example, as shown in Figs. 9 and 10, radiator 3 is symmetrical about plane 17.

Rutfors et al. and Colburn et al. are described above. Rutfors et al. do not disclose or suggest that each of a load conductor and a first radiator has a shape symmetrical (electrically symmetrical) about a plane, where the plane extends perpendicular to the ground board and passes through the first feeding point, as required by claims 3 and 4. Instead, as shown in Fig. 3 of Rutfors et al., PIFA antenna 20 and feeding portion 22 are not symmetrical about any single plane. Furthermore, in Fig. 2 of Rutfors et al., if a plane perpendicular to PCB 10 were to pass through feeding device 24, dipole antenna 230 would not be symmetrical to the plane. Thus, Rutfors et al. can not disclose or suggest that radiators of a balanced antenna are placed at positions symmetrical (electrically symmetrical) about the plane, as required by claims 3 and 4. Thus, Rutfors et al. do not include all of the features of claims 3 and 4.

Colburn et al. are described above. Colburn et al. do not disclose or suggest that each of a load conductor and a first radiator has a shape symmetrical (electrically symmetrical) about a plane, where the plane extends perpendicular to the ground board and passes through the first feeding point, as required by claims 3 and 4. Colburn et al. also do not disclose or suggest a balanced antenna and thus cannot disclose that radiators of a balanced antenna are placed at positions symmetrical (electrically symmetrical) to each other about a plane that extends perpendicular to the ground board and passes through the first feeding point of the unbalanced antenna, as required by claims 3 and 4. In addition, as described above, the skilled person would not be motivated to combine Rutfors et al. and Colburn et al. to produce the subject invention.

Accordingly, Colburn et al. do not include all of the features of claims 3 and 4 and would not be combined with Rutfors et al. Accordingly, allowance of claims 3 and 4 is respectfully requested.

With respect to claim 5, Applicant respectfully traverse this ground of rejection for the reasons set forth below.

Claim 5 includes features neither disclosed nor suggested by the cited art, namely:

... the load conductor of the unbalanced antenna includes a first portion and a second portion, the first portion of the load conductor being provided between the first end of the load conductor and the connection point, the second portion being provided between the second end of the load conductor and the connection point ...

... an impedance Z11 of the first portion of the load conductor, a mutual impedance Z12 of the second radiator to the first portion of the load conductor, a mutual impedance Z21 of the first portion of the load conductor to the second radiator, an impedance Z22 of the second radiator, an impedance Z33 of the second portion of the load conductor, a mutual impedance Z34 of the third radiator to the second portion of the load conductor, a mutual impedance Z43 of the second portion of the load conductor to the third radiator, and an impedance Z44 of the third radiator satisfy the relation of ...

Rutfors et al. do not disclose or suggest Applicant's claimed features of "the load conductor of the unbalanced antenna includes a first portion and a second portion, the first portion ... being provided between the first end of the load conductor and the connection point, the second portion being provided between the second end of the load conductor and the connection point" (emphasis added). These features are neither disclosed nor suggested by Rutfors et al. Instead, as described above, Rutfors et al. disclose PIFA antenna 20 having a feeding portion 22 connected to feeding device 24. Rutfors et al. are silent on a load conductor having first and second portions with respectively connected to a connection point.

As acknowledged by the Examiner on pages 4-5 of the Office Action, Rutfors et al. fail to explicitly teach impedances of the first and second portions of the load conductor

(Z11, Z33), mutual impedances between the first portion of the load conductor and the second radiator (Z12, Z21), an impedance of the second radiator (Z22), mutual impedances between the third radiator and the second portion of the load conductor (Z34, Z43) and an impedance of the third radiator (Z44) or that the impedances satisfy a relationship as recited in claim 5. Thus, Rutfors et al. do not include all of the features of claim 5.

Colburn et al. are described above. Colburn et al. do not make up for the deficiencies of Rutfors et al. because Colburn et al. do not disclose or suggest that a load conductor of a unbalanced antenna includes a first portion and a second portion provided to a connection point. Colburn et al. also do not teach that impedances of the first and second portions of the load conductor, mutual impedances between the first and second portions of the load conductor and the second and third radiators, and impedances of the second and third radiators satisfy a relationship as recited in claim 5. Accordingly, allowance of claim 5 is respectfully requested.

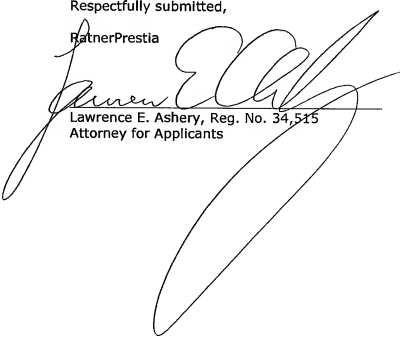
Claim 6 includes all of the features of claim 5 from which it depends. Accordingly, claim 6 is also patentable over the cited art.

Claims 7 and 8 have been added. No new matter is introduced herein. Support for claims 7 and 8 can be found, for example, at Figs. 9 and 10. Claims 7 and 8 include all the features of respective claims 3 and 4 from which they depend and are also patentable over the cited art.

In view of the amendments and arguments set forth above, the above-identified application is in condition for allowance, which action is respectfully requested.

Respectfully submitted,

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